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Inside This Issue

Adrenal Incidentalomas: An Approach to Uncertainty

Adrenal incidentaloma is defined as an adrenal mass 1 cm or more in diameter that is discovered serendipitously by radiologic examination, in the absence of symptoms or clinical findings suggestive of adrenal disease. As imaging techniques have improved and computed imaging has become accepted practice in medicine, the identification of adrenal incidentalomas has become more frequent.

William F. Young, Jr, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, says: "Adrenal incidentalomas are not new. Instead of finding them at autopsy, we are now finding them during life with computed imaging. There is an age-dependent occurrence of adrenal cortical adenomas found at autopsy. Thus, the probability of finding an unsuspected adrenal adenoma on computed abdominal imaging in a 20- to 29-year-old person is approximately 0.2%, compared with 7% in a person older than 70 years." The majority of adrenal incidentalomas are clinically nonhypersecretory benign adrenal cortical adenomas. However, more than 45 different diagnoses have been reported in patients with incidentally discovered adrenal masses (Table on page 2).

An adrenal incidentaloma should be characterized with respect to both functional status, with a medical history, physical examination, and hormonal assessment, and malignant potential, with an assessment of the imaging phenotype and mass size.

Hormonal Evaluation

The term "subclinical Cushing's syndrome" describes adrenal incidentaloma with autonomous cortisol-secreting cortical adenomas in patients who lack the typical signs and symptoms of hypercortisolism. Subclinical Cushing's syndrome affects 8% of all adrenal incidentaloma patients. Although these patients lack the usual obvious signs of Cushing's syndrome, they may have the adverse effects of continuous endogenous cortisol secretion, including hypertension, obesity, diabetes, and osteoporosis. Because their 24-hour urinary cortisol secretion may be normal, all adrenal incidentaloma patients should undergo a 1-mg overnight dexamethasone suppression test.

Geoffrey B. Thompson, MD, and William F. Young, Jr, MD

Of all patients with adrenal incidentalomas, approximately 5% prove to have pheochromocytomas. Even though clinically silent, pheochromocytomas can be lethal. In evaluation of an adrenal incidentaloma patient, the clinician has a powerful predictor of pheochromocytoma, the "imaging phenotype." Dr Young says: "The imaging phenotype is so powerful that, even when biochemical testing for pheochromocytoma is normal but the imaging phenotype is typical of pheochromocytoma, these patients should be treated with α-adrenergic and β-adrenergic blockade and tumor resection. At Mayo Clinic, the most reliable biochemical method for identifying adrenal pheochromocytoma is measuring fractionated metanephrines and catecholamines in a 24-hour urine collection, the sensitivity and specificity of which are both 98%."

All patients with adrenal incidentalomas who have hypertension should be evaluated for primary aldosteronism. A reasonable screening test is determination of the ambulatory morning plasma aldosterone concentration–to–plasma renin activity ratio (PAC/PRA ratio, where PAC is reported in ng/dL and PRA is reported in ng/mL per hour). The PAC/PRA ratio can be obtained while the patient is treated with any antihypertensive drug except spironolactone, eplerenone, or high-dose amiloride. A PAC/PRA ratio of 20 or higher and a PAC of 15 ng/dL or higher

Table. Differential Diagnosis of Asymptomatic Adrenal Incidentalomas

Benign nonfunctioning mass
- Adenoma
- Adenomatoid tumor
- Adrenolipoma
- Amyloidosis
- Cyst
- Ganglioneuroma
- Granuloma
- Hamartoma
- Hematoma
- Hemangioma
- Infection (fungal, tuberculosis, echinococcosis, cryptococcosis, nocardiosis)
- Leiomyoma
- Lipoma
- Lymphangioma
- Myelolipoma
- Neurofibroma
- Oncocytoma
- Pseudocyst
- Teratoma

Malignant nonfunctioning mass
- Adrenocortical carcinoma
- Angiosarcoma
- Ganglioneuroblastoma
- Leiomyosarcoma
- Liposarcoma
- Malignant peripheral nerve sheath tumor
- Metastatic carcinoma (eg, breast, lung, kidney, stomach, pancreas, ovary, colon, esophagus)
- Primary malignancy
- Primary malignant melanoma
- Primitive neuroectodermal tumor

Subclinical hyperfunctioning mass
- Composite pheochromocytoma
- Congenital adrenal hyperplasia
- Androgen- and estrogen-secreting neoplasms
- Massive macronodular hyperplasia
- Nodular hyperplasia
- Pheochromocytoma
- Primary aldosteronism
- Primary malignancy
- Sex cord-stromal tumor
- Subclinical Cushing's syndrome

Pseudoadrenal mass
- Mistaken vasculature
- Liver
- Lymph nodes
- Pancreatic mass
- Renal mass
- Spleen
- Stomach mass
- Technical artifact

Adapted from Young WF Jr. Management approaches to adrenal incidentalomas: a view from Rochester, Minnesota. *Endocrinol Metab Clin* North Am. 2000;29:159-85.

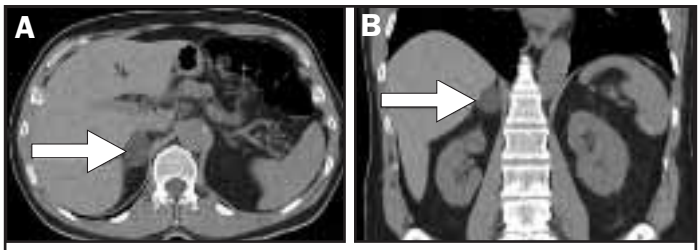


Figure 1. An abdominal CT scan (A, axial image; B, coronal image) obtained to evaluate nonspecific abdominal pain shows a round, uniform, low-density 2-cm right adrenal mass (arrows). Results of hormonal testing in this 66-year-old hypertensive man for subclinical Cushing's syndrome, primary aldosteronism, and pheochromocytoma were normal. The patient is being followed with repeat imaging and hormonal testing.

constitute a positive screening test result; however, the cutoff for a positive test is laboratory dependent.

Assessment of Malignant Potential

Computed imaging is the most powerful tool available to the clinician to guide the management of patients with adrenal incidentaloma. Geoffrey B. Thompson, MD, of the Department of Surgery at Mayo Clinic in Rochester, notes: "The lipid-rich nature of cortical adenomas is helpful in distinguishing these benign neoplasms from malignancy." Imaging characteristics consistent with a benign cortical adenoma include round and homogeneous density, smooth contour and sharp margination, diameter usually less than 4 cm; unilateral location, low unenhanced CT attenuation values, and marked CT contrast medium washout (Figure 1). The imaging phenotype consistent with pheochromocytoma includes delayed contrast medium washout on CT, high signal intensity on T2-weighted MRI, cystic and hemorrhagic changes, and variable size (Figure 2). Adrenocortical carcinoma imaging characteristics include irregular shape, inhomogeneous density because of central areas of low attenuation due to tumor necrosis, tumor calcification, diameter usually more than 4 cm, unilateral location, high unenhanced CT attenuation values, and inhomogeneous enhancement on CT with intravenous contrast medium. The imaging phenotype of metastases includes irregular shape and inhomogeneous nature, tendency to be bilateral, high unenhanced CT attenuation values, and delayed intravenous contrast medium washout on CT.

The greatest lesion diameter of the adrenal mass is predictive of malignancy. In 1 study, a 4-cm cutoff was 90% sensitive for detecting adreno-cortical carcinoma, even though 76% of lesions more than 4 cm in diameter were benign. Dr Thompson cautions: "Clearly, adrenal mass size should not be used as the only variable to guide treatment. The primary role of fine-needle aspiration (FNA) biopsy is to differentiate adrenal from nonadrenal tissues (eg, metastases or infection); FNA biopsy cannot distinguish between primary adrenal benign and malignant lesions. Pheochromocytoma should always be excluded with normal biochemistry before attempting FNA biopsy of an adrenal mass."

Frequency and Duration of Follow-up

An area of uncertainty in the management of a patient with adrenal incidentaloma is the frequency and duration of follow-up evaluations. Autonomous function (glucocorticoid and catecholamine) not present at baseline can be detected with longer-term follow-up (eg, 4 years). Repeat imaging at 3 months, 1 year, and 2 years may be helpful in excluding primary and metastatic malignancy.

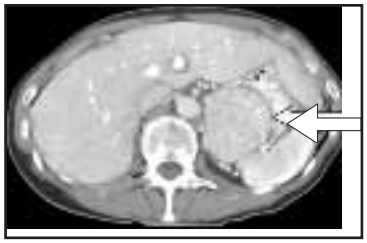


Figure 2. An abdominal CT scan obtained to evaluate bilateral leg swelling shows a dense 6.5×5.4-cm, heterogeneously enhancing mass in the left adrenal gland (arrow). Results of hormonal testing in this 61-year-old normotensive woman were positive for pheochromocytoma. The patient was treated with α- and β-adrenergic blockade followed by laparoscopic adrenalectomy where a 7×5×5-cm pheochromocytoma was removed.

A Clinical Conundrum: The Diagnosis and Treatment of Androgen Deficiency in Older Men

Testosterone replacement in young men with hypogonadism maintains or improves bone mineral density, body composition, virilization, libido, sexual function, and sense of well-being. As men age, however, it is difficult to differentiate true hypogonadism from the changes of normal aging. There is uncertainty if the physiologic changes of aging are due to testosterone deficiency and if treating normal older men with testosterone is beneficial. Because testosterone-dependent diseases such as benign and malignant prostate growth become very common as men age, the risk/benefit ratio for testosterone replacement in older men is more difficult to define than it is in young men.

Todd B. Nippoldt, MD

Large epidemiologic studies document a decline in testosterone production and an increase in sex hormone–binding globulin (SHBG) as men age, resulting in a much greater decline in the active fraction, measured as free or bioavailable testosterone (Figure). Most studies testing the effects of testosterone administration in normal elderly men included men older than 60 years whose baseline total testosterone levels were in the low-normal to mildly low range (eg, <350 ng/dL) or had bioavailable testosterone levels less than 70 ng/dL. These studies, most of which were published between 1990 and 2002, have been of short duration and included relatively small numbers of subjects. Although the results from the various studies are not entirely consistent, a composite of the changes seen with testosterone treatment in older men is shown in the Table on page 4. Todd B. Nippoldt, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, cautions: "It is important to emphasize that there are no data on clinically important end points, such as bone fracture risk, cardiovascular events, development of malignancy, or mortality, for testosterone treatment in normal elderly men."

Men with gynecomastia, osteoporosis, diminished libido, erectile dysfunction, loss of muscle mass, beard, or body hair, or hot flashes warrant an evaluation for hypogonadism. Because of the increased level of SHBG with aging, the laboratory evaluation in older men should start with a measurement of total testosterone along with free or bioavailable testosterone. Dr Nippoldt notes: "It is important to determine the etiology of a low testosterone level before starting replacement therapy. Blood levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH), and

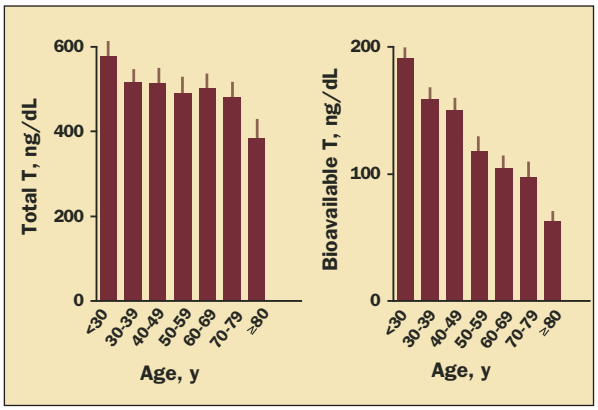


Figure. Total and bioavailable testosterone (T) levels from 346 men in Rochester, Minnesota, stratified by age. (Data from Khosla S, et al. Relationship of serum sex steroid levels and bone turnover markers with bone mineral density in men and women: a key role for bioavailable estrogen. *J Clin Endocrinol Metab.* 1998;83:2266-74. Copyright 1998, The Endocrine Society. Reprinted with permission.)

prolactin should be measured in all men with low testosterone levels. Elevated serum LH and FSH concentrations indicate primary testicular failure, and no further studies are needed. Elevated serum prolactin levels, in the absence of prolactin-increasing drugs, should dictate computed imaging of the sellar region."

Low (or "inappropriately normal") LH and FSH imply a central cause for hypogonadism, which may be functional or structural. A functional abnormality in the hypothalamic-pituitary axis is more common. This functional abnormality may be idiopathic or due to "normal aging," but several medical conditions should be considered as well: obstructive sleep apnea, recent illness or surgery (eugonadal sick syndrome), extreme emotional distress, or adverse effects of medications (eg, high-dose glucocorticoids, narcotic pain relievers, or drugs that increase prolactin). The only way to definitively exclude a structural lesion is by sellar computed imaging. The decision to obtain sellar MRI depends on the severity of the deficiency, the patient's age, and the potential presence of other pituitary dysfunction or mass effect (eg, headaches or vision disturbance).

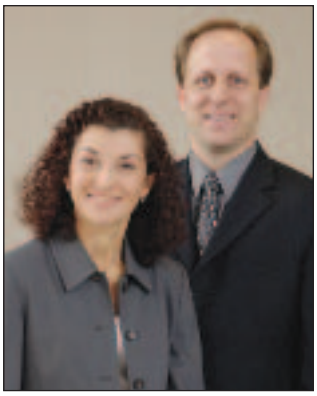
The decision on whether to begin testosterone replacement in an elderly man may be difficult. There are no definitive data regarding the level of testosterone required to prevent osteopenia and maintain muscle mass. However, values of total testosterone less than 200 ng/dL or bioavailable testosterone less than 70 ng/dL are probably

inadequate, and patients with these levels should be considered for replacement, even in the absence of hypogonadal symptoms. Many men have symptoms compatible with hypogonadism with testosterone values at the lower end of the normal range or just mildly diminished, and it is difficult to know if this is the cause for these symptoms. Dr Nippoldt says: "In this situation, a therapeutic trial of testosterone replacement is warranted. Replacing testosterone in doses adequate to bring the total testosterone level to the mid-normal range and bioavailable testosterone level higher than 80 ng/dL for at least 3 months is usually an adequate trial. Elderly men metabolize testosterone at a slower rate than younger men and usually require lower doses than those typically used for young hypogonadal men. If the testosterone replacement trial has no impact on the symptoms, testosterone replacement should be discontinued."

Table. Changes Seen With Testosterone Treatment in Older Men

Lean body mass	No change or increases (0%-5%)
Fat mass	No change or decreases (0%-25%)
Strength	No change or modest increase
Physical functioning	No change
Sense of well-being	Improves
Libido	Increases
Erectile dysfunction	No change (improves in those with very low T)
Spatial cognition	Improves
Memory	No effect
Bone resorption/ formation markers	Improves or no change
Bone mineral density	No change (increases in those with very low T)
Total cholesterol	Declines (9%-12%)
HDL cholesterol	No change
LDL cholesterol	Declines (11%)
Insulin sensitivity	No change or improves (equivocal)
IGF-1 level	Increases
PSA	No change or increases (remains in normal range)
Prostate volume	Minimal increase
Hematocrit	Increases (0%-7%), more if sleep apnea is present

Potential risks for parenteral testosterone replacement include exacerbating or unmasking benign prostatic hypertrophy, prostate cancer, obstructive sleep apnea, and polycythemia. No studies have defined the incidence of these potential risks or the cost-effectiveness of pretreatment screening or monitoring. Dr Nippoldt advises: "In the absence of these data, it is reasonable to obtain baseline digital rectal examination, prostate-specific antigen level, complete blood cell count, and a history regarding the potential for obstructive sleep apnea. The frequency of rechecking these studies during therapy depends on the patient's age, family history, and baseline values. Any new symptom should be investigated. If polycythemia develops, overnight polysomnography should be considered to exclude obstructive sleep apnea."



Maria L. Collazo-Clavell, MD, and Michael L. Kendrick, MD

Bariatric Surgery: Important Considerations for the Clinician and Patient

The number of bariatric operations performed in the United States is increasing each year. Several factors have contributed to this trend: the continued rise in the prevalence of severe obesity, the lack of effective medical therapies for obesity, and a growing body of literature reporting multiple health benefits in patients who have undergone bariatric procedures. As a result, patients, physicians, and third-party payers have become more receptive to this therapy.

Counseling the patient interested in bariatric surgery presents many challenges. Maria L. Collazo-Clavell, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, comments: "Several bariatric operations are offered that vary in their mechanisms of weight loss, effects on medical comorbidities, and perioperative and long-term risks. Adding to the complexity, institution-specific outcomes may not always reflect the published results achieved by more established and experienced centers."

Bariatric operations are categorized by their mechanism of weight loss, restriction of dietary

intake, and induction of maldigestion/malabsorption of calories. The restrictive procedures available are the vertical banded gastroplasty (VBG) and the laparoscopic adjustable gastric band (LAGB). The VGB consists of a stapled proximal gastric pouch with a fixed (nonadjustable) outlet created by a mesh band or silicone rubber ring. Lower perioperative morbidity and an acceptable early weight loss compared with Roux-en-Y gastric bypass (RYGB) were encouraging, but several randomized trials have demonstrated inferior weight loss compared with RYGB. The LAGB procedure has 2 components—a silicone band with an inner inflatable cuff and a reservoir connected by tubing (Figure 1). The band is placed around the gastric cardia to create a small (15 mL) proximal gastric pouch with an adjustable restrictive outlet that limits the amount of food that can be consumed. The reservoir is implanted in the subcutaneous tissue of the abdominal wall where it can be accessed percutaneously to either add or remove saline to adjust the inflatable cuff (Figure 1). Michael L. Kendrick, MD, of the Department of Surgery at Mayo Clinic in Rochester, comments: "This adjustable feature provides the ability to fine-tune the desired effect of restriction. The absence of any bowel transection or anastomosis leads to lower perioperative risks. Disadvantages include less weight loss and lower resolution of weight-related comorbid conditions compared with RYGB and lack of long-term outcome data. Intermediate and long-term complications can be substantial, with reoperation required in up to 20% of patients. At Mayo Clinic Rochester, we no longer offer the VBG and offer the LAGB only in limited clinical circumstances."

Dr Kendrick explains: "RYGB is the most common bariatric surgery performed at our institution and nationwide. The current procedure consists of a small proximal cardia pouch (10-30 mL) and a 75- to 150-cm Roux limb (Figure 2). The length of the Roux limb can vary, influencing the weight loss observed and risk for nutritional sequelae. In several series, RYGB has provided greater initial and sustained weight loss than purely restrictive operations and has demonstrated long-term effectiveness with reduction of comorbidities and minimal risk for long-term nutritional complications."

Several malabsorptive procedures are available. Modifications to the RYGB, with lengthening of the Roux limb and shortening of the common channel, promote a malabsorptive rather than maldigestive physiology (long-limb RYGB, the very, very long-limb RYGB [VVLL-RYGB], and the distal RYGB). Biliopancreatic diversion (BPD) is a short common channel procedure combined with a distal gastrectomy, capable of achieving marked and sustained weight loss. The increased incidence of stomal ulceration, severe protein-calorie malnutrition, diarrhea, and dumping has limited its broad acceptance. The duodenal switch (DS) involves transection of the first portion of the duodenum with resection of the greater curvature of the stomach leaving a 100- to 150-mL lesser curvature-based gastric sleeve with an intact antrum and pylorus. The proximal ileum is divided 250 cm from the ileocecal junction, and the biliopancreatic limb is anastomosed to the distal ileum, creating a short (100 cm) common channel. A duodenoileostomy is then constructed, bringing the Roux limb up to the gastric sleeve. Advantages of the DS include reduced stomal complications, absence of

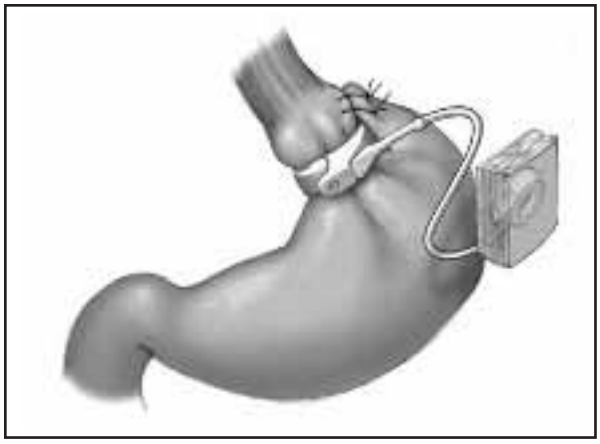


Figure 1. The LAGB bariatric operation. The LAGB consists of a silicone band with an inner inflatable cuff and a reservoir connected by tubing.

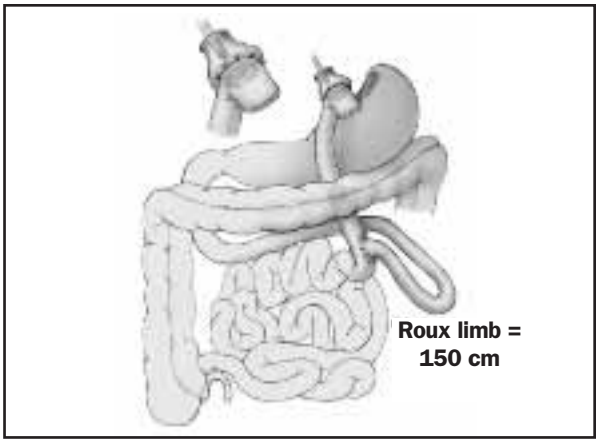


Figure 2. The RYGB procedure consists of a small proximal cardia pouch (10-30 mL) and a 75- to 150-cm Roux limb.

dumping, excellent long-term maintenance of weight loss, and decreased incidence of severe protein-calorie malnutrition with the DS compared with BPD. At Mayo Clinic Rochester, the VVLL-RYGB and the DS are offered to individuals with body mass index (calculated as weight in kilograms divided by the square of height in meters) greater than 55 in whom malabsorptive procedures are associated with superior weight loss.

Dr Collazo-Clavell notes: "A patient's decision to consider bariatric surgery is not an easy one. Which bariatric procedure is best for an individual depends on multiple factors—amount of weight loss desired, preexisting medical comorbidities, and preference, to name a few." Each year, more than 300 bariatric procedures are performed at Mayo Clinic Rochester and Mayo Clinic Arizona. Multidisciplinary teams of nutritionists and specialists from the fields of surgery, internal medicine, psychology, and psychiatry work in an integrated fashion to evaluate, educate, and prepare patients in hopes of maximizing success and minimizing short- and long-term complications of bariatric surgery for weight loss.

A Practical Approach to the Patient With Subclinical Hypothyroidism

Subclinical hypothyroidism occurs when the serum thyroid-stimulating hormone (TSH) level rises above the upper limit of normal (ULN) despite a normal serum free thyroxine (FT4) concentration. Subclinical hypothyroidism or mild thyroid failure is a common problem with a prevalence of 4% to 8.5% in the adult population. The prevalence of subclinical hypothyroidism increases with advancing age and is higher in women (Figure on page 7).

Because serum TSH has a log-linear relationship with circulating thyroid hormone levels (eg, a 2-fold change in FT4 produces a 100-fold change in TSH), it is the key test for the diagnosis of subclinical hypothyroidism. Vahab Fatourechi, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, notes: "The laboratory reference ranges for TSH and FT4 may not be representative of a given individual's personal normal range. That is, the laboratory reference ranges are wider than the ranges of thyroid hormones that are typically observed in an individual over time. For the diagnosis of subclinical hypothyroidism, other causes of elevated serum TSH, such as recovery from nonthyroidal illness, assay variability, heterophil antibodies, central hypothyroidism with biologically inactive TSH, and thyroid hormone resistance, should be excluded. However, the most common cause of elevated serum TSH is autoimmune thyroid disease."

What Is the Upper Limit of Normal for TSH?

The ULN for serum TSH is the subject of hot debate. The reference range used by Mayo Medical Laboratories is 0.3 to 5.0 mIU/L. However, data that support a move to lower the ULN of TSH to 3.0 mIU/L and possibly 2.5 mIU/L have been published. These lower ULN cutoffs are obtained if individuals at risk of thyroid disease are excluded from the reference range population. The strongest argument for lowering the ULN of TSH is the higher rate of positive antithyroid antibodies (reflecting underlying autoimmune thyroid disease) for individuals with TSH concentrations between 3 and 5 mIU/L and the higher rate of progression to clinical thyroid disease for this subgroup. The argument against lowering the ULN for serum TSH is that 22 million to 28 million additional individuals in the United States would be considered hypothyroid if the ULN of the TSH range were decreased to 2.5 to 3.0 mIU/L. Dr Fatourechi cautions: "Our own data show that decreasing the ULN of the TSH reference range to 3.0 mIU/L results in a 3-fold increase in the diagnosis of hypothyroidism in patients without a history of thyroid disease. Yet there is no evidence that intervention at these levels of TSH is beneficial. In fact, some evidence shows that lowering serum TSH to the proposed new normal range by adjustment of the thyroxine dose does not improve patients' well-being or their nonspecific complaints." Dr Fatourechi continues: "Obviously for patients with TSH levels between 3 and 5 mIU/L, follow-up and possibly measurement of thyroperoxidase (TPO) antibody may be considered."

Vahab Fatourechi, MD

Should All Patients With Subclinical Hypothyroidism Be Treated With Thyroid Hormone Replacement?

There is consensus for initiating thyroxine replacement therapy for all patients with elevated TSH higher than 10 mIU/L, even if FT4 is within the normal laboratory range. However, controversy continues concerning whether patients with serum TSH levels between 5 and 10 mIU/L should be treated. The argument in favor of replacement therapy is based on numerous proposed consequences of untreated subclinical hypothyroidism: progression to clinical hypothyroidism, subtle systemic symptoms of hypothyroidism, lipid abnormalities, adverse cardiac end points, cardiac dysfunction, adverse fetal effects and pregnancy outcomes, possible contribution to infertility, neuromuscular dysfunction, psychiatric dysfunction, and cognitive dysfunction.

Dr Fatourechi explains: "If studies show that mildly elevated serum TSH has adverse cardiac effects, then therapy of all cases of subclinical hypothyroidism will make sense. Several investigators have demonstrated subtle cardiovascular dysfunction in subclinical hypothyroidism, but clinical significance is questionable. However, to date, most studies have shown a lack of association of subclinical hypothyroidism with cardiac events and cardiovascular mortality. Surprisingly, the results of an epidemiologic study suggested that for individuals older than 80 years a slightly higher-than-normal TSH had survival benefit. Because of the large number of individuals potentially impacted, there is an urgent need for settling this controversy. Until guidance from carefully designed randomized trials becomes available, individuals with serum TSH levels between 5 and 10 mIU/L should be treated selectively. Thyroxine replacement therapy should be reserved for patients who have goiter, women who are anticipating pregnancy or are pregnant, or patients with depression or bipolar disorder. Patient preference, clinical circumstance, age, presence of symptoms of hypothyroidism, TPO antibody positivity, and level of and progression of TSH over time should also be considered. We also suggest that subclinical hypothyroidism associated with autoimmune thyroiditis of children and adolescents should be treated. Our data show that patients with serum TSH levels above 8 mIU/L have a high likelihood of progression to TSH above 10 mIU/L in 4 years and may be considered for thyroxine replacement therapy.

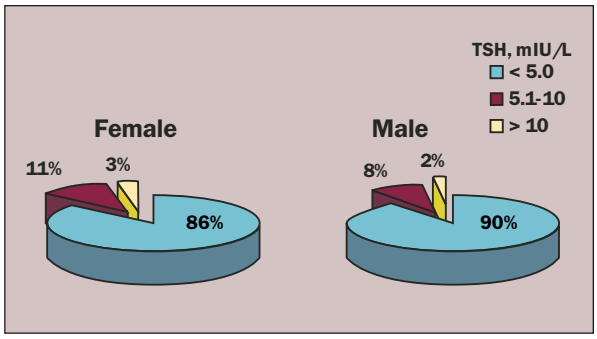


Figure. Serum TSH levels in 123,958 patients aged 50 years or older seen at Mayo Clinic, 1995-1997.

"Improvement in serum lipid levels with thyroxine replacement therapy is more likely for patients who have baseline TSH levels higher than 10 mIU/L. If hyperlipidemia is encountered in a patient with a serum TSH between 5 and 10 mIU/L, specific lipid-directed therapy or lifestyle changes are needed. Some of these recommendations do not have definitive evidence-based support; however, we believe a practical approach is needed until more evidence becomes available."

Endocrinology Update

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10th Mayo Clinic Endocrine Course

The 10th Mayo Clinic Endocrine Course will be held March 18-23, 2007, on the Big Island of Hawaii. This course, created for endocrinologists and interested internists and surgeons, will present the latest material on the diagnosis and treatment of endocrine disorders. This 5-day course (7:30 AM to 12:30 PM daily) will span the full spectrum of endocrinology through short lectures, case-based debates, clinicopathologic sessions, clinical pearls sessions, and small group discussions with experts. The digital audience response system will be used extensively, and there will be many opportunities for interaction with the course faculty. Optional sessions on thyroid ultrasonography and technology in diabetes will be offered.

Mayo Clinic Nutrition in Health and Disease

Mayo Clinic Nutrition in Health and Disease will be held November 8-9, 2007, at the Hilton San Francisco Financial District in San Francisco, California. This course, designed for physicians, dietitians, nurses, and pharmacists, will provide an in-depth overview of challenging nutritional issues that clinicians encounter in the ambulatory and hospital settings.

Mayo Clinic Rochester Endocrine Surgeons

Geoffrey B. Thompson, MD, David R. Farley, MD, Melanie L. Richards, MD, and Clive S. Grant, MD

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